PROCENTEC

User Manual
PROFINET Cable Tester

4- and 8-wire industrial PROFINET cable
Straight and 90° metal or plastic PROFINET plugs
Regular Ethernet cable and plugs
Shielding
Wire breaks
Short circuits
Swaps
Miswiring
Split pairs
Can also test telephone and coax cable

Version 1.2 – 27 April 2009

PROCENTEC

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Safety Guidelines
This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning sign and are marked as follows according to the level of danger:

Draws your attention to important information on handling the product, a particular part of the documentation or the correct functioning of the product.

Warning
This device and its components may only be used for the applications described in this manual and only in connection with devices or components that comply with the Ethernet standard.
This product can only function correctly and safely if it is transported, stored, set up, installed, operated and maintained as recommended.

Do **NOT** attach to AC power. The cable tester may be damaged and can cause a safety hazard for the user.

Disclaimer of Liability
We have checked the contents of this manual as much as possible. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the content in this manual is reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

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Important Information

Purpose of the Manual
This user manual provides information how to work with the PROFINET Cable Tester.

Recycling and Disposal
The parts of the PROFINET Cable Tester can be recycled. For further information about environment-friendly recycling and the procedure for disposing of your old equipment, please contact:

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Contents

1 Product Description 7
1.1 Features 7
1.2 Application areas 7

2 Operating modes 8
2.1 PROFINET/Ethernet test mode (DATA/SEL Button) 9
2.2 Tone generator (TONE button) 9
2.3 Telephone test mode (VOICE button) 10
2.4 Coax test mode (VIDEO button) 10
2.5 Split pair test 10
2.6 Voltage detection 10
2.7 Battery replacement 10

3 Testing PROFINET / Ethernet cable 11
3.1 Interpreting PROFINET test results 13
3.1.1 Correct wiring (with Shield) 14
3.1.2 Correct wiring (without Shield) 14
3.1.3 Wire break 14
3.1.4 Short circuit 15
3.1.5 Miswire 15

4 Testing other cable 16
4.1 Testing Video/Coax Cable 16
4.2 Testing Telephone cable 16
4.3 Placing a tone on a cable 16

5 Training 17

6 Technical Data 18

7 Hot keys 19

9 Sales offices and Distributors 20

10 Order Codes 23

12 Glossary 24

13 Certificates 25

14 Revision History 27

15 Next version 28

16 Notes 29

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1 Product Description

PN1, the first handheld PROFINET cable tester is an essential tool to verify the condition of the PROFINET cable after assembly and installation.

It is a robust tester which has been especially designed for PROFINET and suitable for industrial environments. With just 1 key-press the test result is directly displayed and continuously updated.

If a cable did not pass the test, it will clearly indicate what the problem is and which wires/pins are affected. This product does not require special skills. It is easy to use and gives the technician quick and understandable feedback about the quality of the wiring. It can also be utilized on all other Ethernet networks with 4-wire and 8-wire shielded cables.

This outstanding tool that fits in your pocket will boost the efficiency of installers and maintenance technicians.

1.1 Features

- ✓ **Suitable for 4- and 8-wire PROFINET and regular Ethernet cables (CAT6, CAT-5E, CAT-5, CAT-4 and CAT-3).**
- ✓ **Suitable for straight and 90° metal or plastic PROFINET plugs.**
- ✓ **Tests cable shielding!**
- ✓ **Detects short circuits, wire breaks, swaps, miswiring and split pairs.**
- ✓ **Large LCD clearly indicates the test results.**
- ✓ **150 hours on one 9 V battery.**
- ✓ **Operating temperature: 0 to 50 °C.**
- ✓ **Just 1-key-press to start continuous testing.**
- ✓ **It can also test telephone and coax cable.**

1.2 Application areas

- ✓ **Cable testing during installation phase.**
- ✓ **Commissioning.**
- ✓ **Education.**

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2 Operating modes

The PROFINET Cable Tester runs in 4-modes. The mode is selected with 4 buttons.

☞ The cable tester is switched ON by pressing any of these buttons and it immediately starts testing in the mode which is pressed. An LCD icon for the currently selected mode will be blinking.

☞ Press any button except the selected mode button to switch the cable tester OFF.

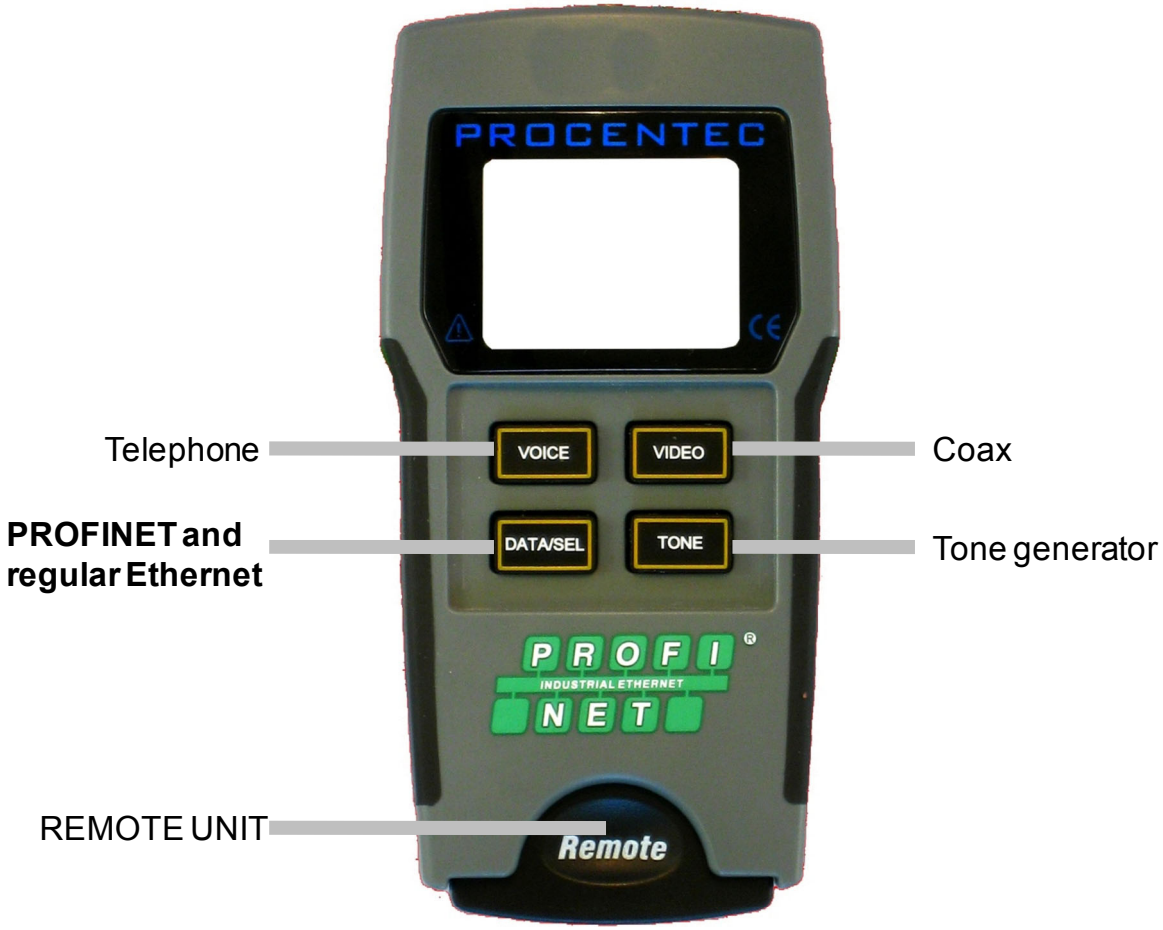

Fig. 1 - Location of the buttons and Remote Unit

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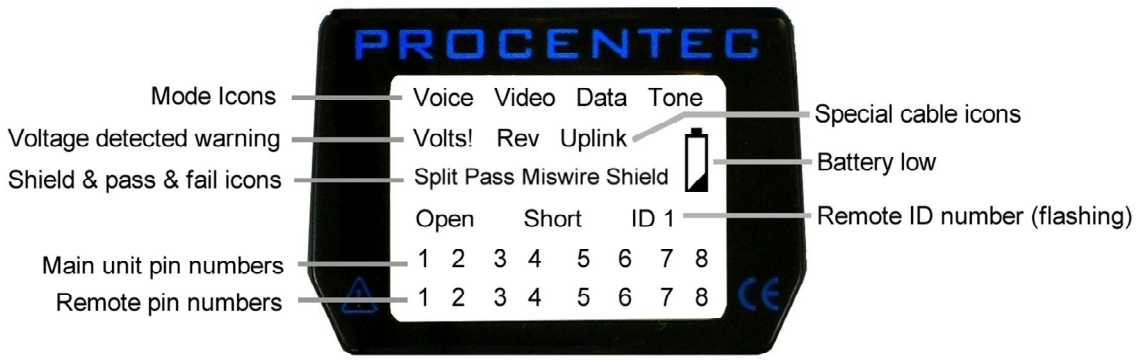

Fig. 2 - LCD layout

2.1 PROFINET/Ethernet test mode (DATA/SEL Button)

In this mode the cable tester uses the RJ 45 Jack on the main unit and the "Remote Unit" to test a cable.

The cable tester can switch between;

- **4 wires / 2-pairs (DATA2 mode)**
  PROFINET and other Industrial Ethernet networks with shielded cable.

- **8 wires / 4-pairs (DATA1 mode)**
  Regular Ethernet or 1Gbps Industrial Ethernet cable.

☞ Press DATA/SEL for 2 seconds to switch between DATA1 and DATA2 mode.

The tester declares pins 1-2, 3-6, (4-5 and 7-8) as pairs and displays the "Pass" icon when all pins are correctly wired in a one-to-one order. If the 1-2 and 3-6 pairs are crossed, the "Pass" icon will be displayed along with a blinking "Uplink" icon. Uplink cables are also known as cross cables. For shielded cable (PROFINET), the remote ID will flash alternately with "S" to indicate presence of shielding.

2.2 Tone generator (TONE button)

The tone mode generates audio tones for use with tone tracers on selected pins.

The signal generated on a pair has the positive signal on one pin and the complement of the signal on the other pin of the pair, yielding a nominal 10 volts peak-to-peak across the pair.

The pin number of the pin or the letters "P" (for pin) and "S"(for shield) being driven with tone and the currently selected tone pattern is displayed on the screen along with the "Tone" icon and the icon for the connector assumed to be used.

☞ The TONE button steps to the next connector pin(s) drive option when pressed less than 2 seconds.

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☞ When the TONE button is pressed and held down for longer than 2 seconds, another tone pattern is selected until the button is released. The tone pattern options are Hi, Lo, HiLo1 and HiLo2. The HiLo options are dual or warble tones of differing pattern duration.

☞ Pressing any button other than TONE, switches OFF the cable tester. The tone will switch OFF automatically after 2,4 hours.

2.3 Telephone test mode (VOICE button)

For this mode the cable tester uses the 6-position jack on the main unit and the remote unit to test a cable. This mode uses the 3-pair USOC standard to define the pairs. Connector pins 1-6, 2-5 and 3-4 are the pairs defined by this standard. The tester will display the “Pass” icon when all 6 pins are correctly wired in a one-to-one order.

If all 6 pins are correctly wired in the reverse order, the “Pass” icon along with a blinking “Rev” icon will be displayed. Standard telephone cables used between a phone set and a wall jack are usually reverse-pinned.

2.4 Coax test mode (VIDEO button)

The cable tester can test wire breaks and short circuits.

2.5 Split pair test

The cable tester has the ability to switch OFF the split pair test. Pressing the button for the current cable test mode for more than 3 seconds, switches OFF the split pair testing. The “Split” icon and its current state (ON or OFF) appear on the screen momentarily to indicate this. The split pair testing will resume the next time the tester is switched ON, or can be toggled by another 3 second press of the current test mode button.

2.6 Voltage detection

The cable tester monitors for voltage being present on the jacks during each test cycle. If voltage is found, the “Volts!” icon is displayed and testing stops until the voltage is removed.

2.7 Battery replacement

When the battery low icon is ON, the battery should be replaced as soon as possible. The cable test results will become unreliable when the battery reaches 4, 5 V. To replace the battery:

- ❑ Remove the screw from the battery door on the back of the unit.
- ❑ Pull the battery out of the cavity and remove the battery link.
- ❑ Connect a new Alkaline 9 V battery to the battery link. Insert the battery back in the compartment with the battery link placed towards the front-end.
- ❑ Close the battery door and do **NOT** over tighten the screw.

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3 Testing PROFINET / Ethernet cable

BEFORE TESTING STARTS, INSPECT THE PLUGS OF THE CABLE.
Improperly crimped or damaged plugs can harm the jacks of the cable tester. Do NOT use 6-pin (phone) plugs with the 8-pin RJ 45 jack.

- ❑ **Take out the Remote Unit of the main unit (squeeze remote at finger grip openings in main unit to remove it).**

Fig. 3 - Taking out the Remote Unit

The Remote Unit has to be placed on the other side of the cable. If the cable is short or both ends are very close to each other, the Remote Unit can be left in the main unit.

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❑ **Plug one end of the cable into main unit and the other end of cable into the remote unit.**

Fig. 4 - Cable attached to the Main and Remote Unit

❑ **If PROFINET cable is tested, switch the split pair test OFF!!!**

☞ Press the DATA/SEL button for 3 seconds to switch split pair OFF (every time the button is pressed for 3 seconds, split pair operation is toggled). By default the cable tester is set to split pair is ON!

❑ **To start testing press the DATA/SEL button.**

☞ Press DATA/SEL for 2 seconds to switch between DATA1: 8 wires (4 pairs) testing and DATA2: 4 wires (2 pairs) testing. By default the cable tester is set to DATA2!

Results are invalid if a cable is attached during a test in progress!

☞ To switch the cable tester OFF, press the VIDEO button.

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3.1 Interpreting PROFINET test results

Upon completion of a cable test, the wire map display, ID and any faults are displayed.

- The top line pin numbers on the display represent the connector pins on the main unit.

- The second line pin numbers represent the connector pin numbers of the remote, normally being the same as the top line for a one-to-one wired cable.

The Pass icon will be ON if the cable has all pins properly connected. The Fail, Short, Open or Split icon will be on if there is a wiring error. The wire map will display the end-to-end connections measured whenever possible.

The Pass icon will also be on with a blinking Uplink icon if a network cable has the 1-2 and the 3-6 pairs transposed to indicate a properly wired uplink/cross cable.

It is very important to check the Shield icon if PROFINET or other Industrial Ethernet cable is tested. IT SHOULD BE ON.

If there are multiple errors to display, there will be a combination of the above error displays. The ID icon will have a number directly to the right of it, indicating the remote ID number detected from the remote. A new test is in progress whenever the “Voice” or “Data” icons are ON.

If a split pair is detected, the detected pins and the “Split” icon will be blinking.

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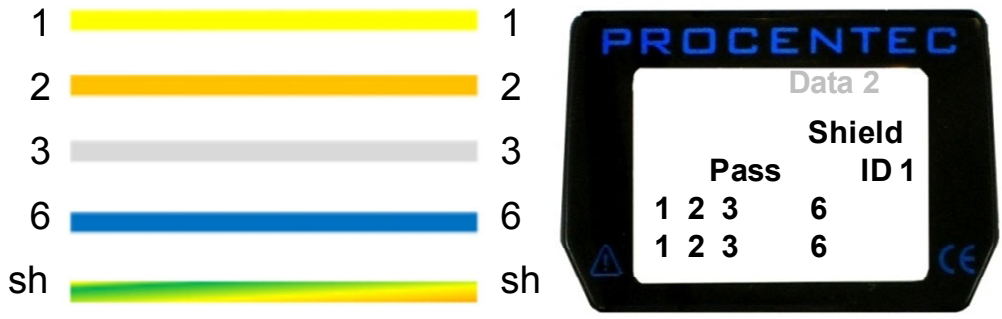
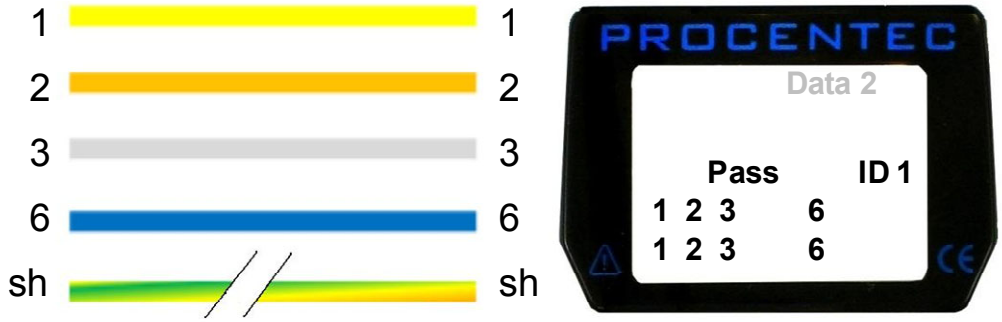
3.1.1 Correct wiring (with Shield)



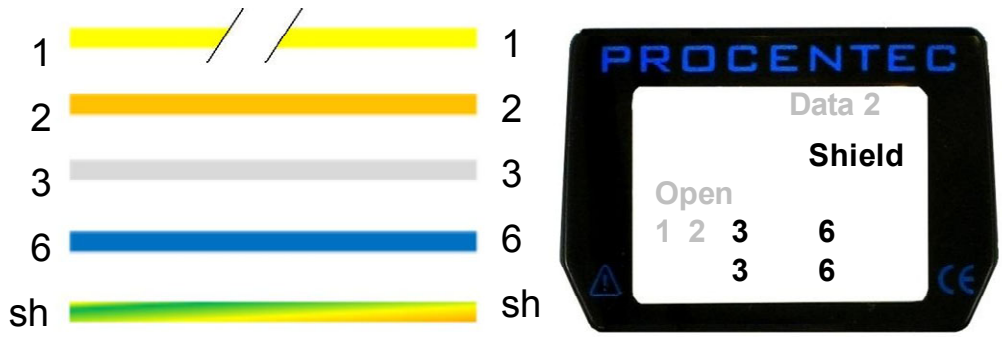
3.1.2 Correct wiring (without Shield)

When the shield has a break or is **NOT** connected, the Shield icon is **NOT** lit. This cable seems to pass, but for PROFINET and other Industrial Ethernet systems, this cable should **NOT** be approved!



3.1.3 Wire break

If a wire break is detected, the affected pins will be blank and the “Open” icon will be ON (blinking).



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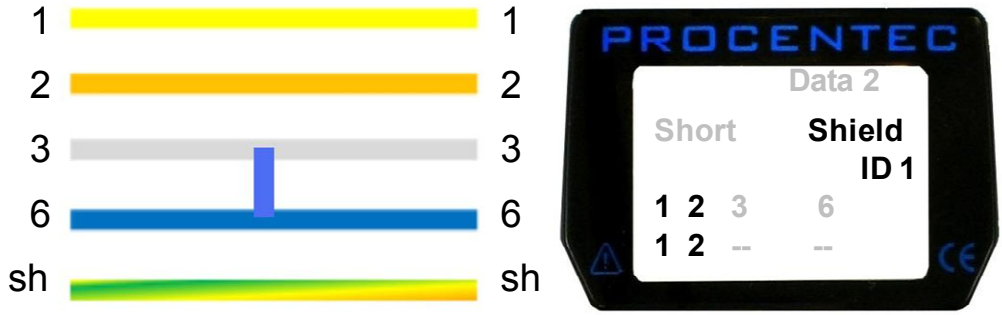
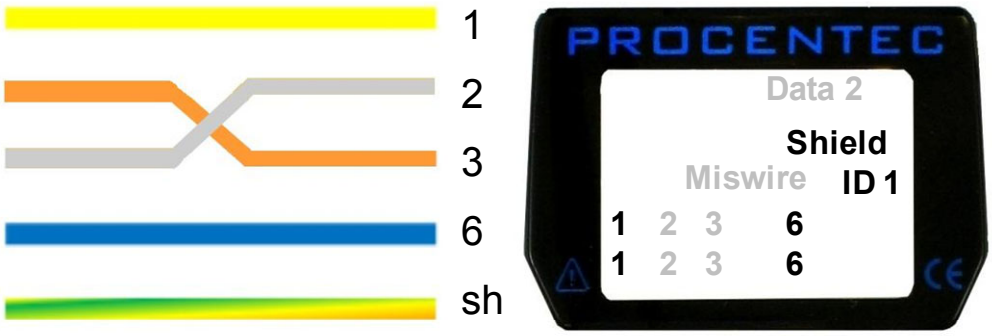
3.1.4 Short circuit

If a short circuit is detected, the second line will have a '-' in those positions along and the "Short" icon will be ON (blinking).



3.1.5 Miswire

If a miswire is detected, the pin numbers will indicate the involved pin numbers and the "Miswire" icon will be ON (blinking).



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4 Testing other cable

4.1 Testing Video/Coax Cable

- ❑ Attach one end of coax cable to be tested to F-connector on main unit.
- ❑ Remove remote unit from main unit by squeezing the remote lightly between the thumb and forefinger through the openings provided in the main unit and pull it out of the main unit and attach it to the other end of the cable to be tested.
- ❑ Press the VIDEO button to switch ON the unit and begin testing. The results are updated once a second.

☞ To switch the cable tester OFF, press the VOICE or DATA button.

4.2 Testing Telephone cable

This is the same procedure as Ethernet cable.

The Rev icon will flash if all connected pins are in reverse order and the Pass icon will also be ON if all 6 connections are present. Telephone modular plug cables used between the wall jack and a phone set are usually reverse pinned.

4.3 Placing a tone on a cable

- ❑ Connect the cable to be traced to a main unit jack. For the best signal, do **NOT** connect a remote to the other end. Due to the shielding effect of twisted pairs, the strongest signal is obtained by having one wire of a pair carry tone. Selecting a single pin instead of a pair will do this. For video coax cable, the Tone is best applied to the shield and the shield should **NOT** be additionally grounded.
- ❑ Switch ON the cable tester by pressing the button associated with the connector to be used followed by pressing the TONE button. Short presses of the TONE button will select a different pin. Holding down the TONE button for more than 2 seconds will select a different tone pattern.

☞ To switch the cable tester OFF, press any button except TONE.

The tone will switch OFF automatically after 2,4 hours.

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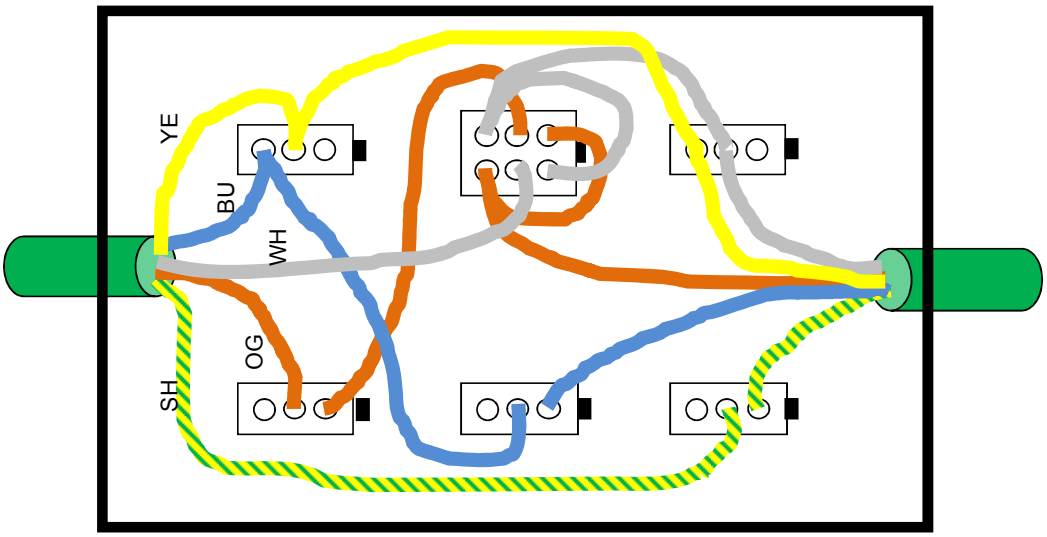
5 Training

This chapter contains an exercise to enhance the practical knowledge of the PROFINET Cable Tester.

Try to recreate the schematic of a “Fault Box” below. It consists of six 2-channel switches which generate faults in the wiring.



When the box is completed hit each switch and fill-out the fault table below.

	S1	S2	S3	S4	S5	S6
1 or 2 = X						
SH = X						
1 = SH						
2 = 3 → 3 = 2						
2 or 6 = X						
OK						
1 = 6						
SH = 1						
1 = 3						
3 = 1 → 1 = 3						
3 or 6 = X						

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6 Technical Data

Dimensions and weight	
Dimensions L x W x H (mm) with DB9 Weight	13,2 × 7,3 × 4,1 cm (5,2 × 2,9 × 1,6 inches) 242 g (8,5 oz.) with battery and Remote Unit
Ambient conditions	
Operating temperature Storage temperature Humidity: Isolation class	0 to 50 °C (32 to 122 °F) -10 to 60 °C (14 to 140 °F) 10 % to 90 %, non-condensing IP 20 (DIN 40 050)
Power supply and operating hours	
Battery Standby Cable testing Tone generator Auto power OFF	9 V Alkaline battery 2,5 years 150 hours 250 hours After 9 minutes the last button was pressed in cable testing modes and after 2,4 hours in tone mode
Ethernet Test	
Cable types Pair resistance to pass test Shield resistance to pass test Cable length for split pair test	Data network cable, CAT6, CAT-5E, CAT-5, CAT-4, CAT-3 Maximum 200 Ohm Maximum 100 Ohm Minimum 2 m cable for testing of split pairs
Coax Test	
Resistance	Maximum 100 Ohm DC resistance, conductor plus shield

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7 Hot keys

Action	Button	Holding down Time
Power ON	**Any button**	Not specified
Power OFF	**Any button, except the selected mode button**	Not specified
Toggle between - 4-wire (2 pairs) - 8-wire (4 pairs) Ethernet test	**DATA/SEL**	2 seconds
Toggle split pair testing	**DATA/SEL**	3 seconds
Select a pin for tone testing	**TONE**	< 2 seconds
Select a tone pattern	**TONE**	> 2 seconds

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10 Order Codes

Component	Order code	Remarks
PROFINET Cable Tester	514-00011A	

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12 Glossary

ID	A number that identifies the Remote Unit.
Miswire	Wires are NOT connected to the correct pins at the other end of the cable. The wire map shows the pin numbers line 1 (main) line 2 (remote). A reverse pair is a special case of a miswire in which the pair is wired to the correct pair of pins or to another designated pair of pins, but the two leads are reversed. The Fail icon and the pin numbers, which are miswired, will be blinking.
Short	One of the wires has a low resistance connection from one wire of the pair to the other wire of the pair or to any other wire in the cable or the shield. A short is indicated by the Short icon being on and blinking + the appropriate pin positions on the second line for the pin numbers involved in the shorts plus a blinking S icon if the shield is shorted.
Split pair	A split pair is an error in the twisting of the wires together within the cable. The cables are made up of 4 or 8 wires twisted together in 2 or 4 pairs. These pairs are designated as pairs by the wiring standards and are intended to carry a signal and its return. 1 -2, 3-6, (4-5 and 7-8) are the pairs designated by T568A/B for an RJ45 jack or plug. A cable can be wired with correct continuity but not with correct pairing. This most often happens when the cable is terminated consistently at both ends, but in the wrong order. A dynamic or AC test is required to detect this type of error. If the only error is a split pair error, the cable has correct continuity. If cross talk is not a concern, as in flat satin cable, the cable is good if the only error is the split pair error. The Split icon and the pin numbers on the first and second line of the wire map with split pairs blinking when there is a split pair error.

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13 Certificates

QualityMasters

Stichting QualityMasters hereby declares that

PROCENTEC
WATERINGEN

Has a management system that meets the requirements of the standard

NEN-EN-ISO 9001:2000

For the scope

Providing training courses, technical support, product development and the exploitation of the test laboratory.

Date of issue	11th April 2008
Valid until	11th April 2013
Certificate number	NL 4792

On behalf of Stichting QualityMasters,

N.B. The failure to meet the conditions as set forth in the certification agreement, or non-compliance with the given standard and/or guidelines, may lead to the suspension or cancellation of the certificate.

This certificate remains the property of Stichting Quality Masters.

SRTCI
ACCREDITED
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PROFI INDUSTRIAL ETHERNET NET

Certificate for a
PI Competence Center

PI confirms that

PROCENTEC
Dennis van Booma
Turfschipper 41
2292 JC Wateringen
THE NETHERLANDS

is a fully accredited
PI Competence Center for PROFINET basic.

This certificate is granted according to the Quality of Services Agreement for PI Competence Centers and is valid for 2 years, until December 31, 2009.

Karlsruhe, May 05, 2008

.....
(Official in Charge)

PROFI PROCESS FIELD BUS BUS

Chairmen of PI

Michael Bryant (Chairman)

Jörg Freitag (Deputy Chairman)

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14 Revision History

Version 1.0 - First release.
Version 1.1 - Minor adjustments.
Version 1.2 - Updated the Distributors.

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15 Next version

- Chapter with theory about PROFINET cabling.
- Chapter with FAQs.
- More items in the glossary.

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16 Notes

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Other PROCENTEC products

Compact PROFIBUS Repeater

- ✓ Single channel PROFIBUS repeater.
- ✓ Transparent.
- ✓ Increased signal strength.
- ✓ Max. 12 Mbps.
- ✓ Auto baudrate detection.
- ✓ Redundant power supply.
- ✓ Digital glitch filtering.
- ✓ No limit in cascading.
- ✓ Integrated switchable termination.
- ✓ Diagnostic LEDs.
- ✓ DB9 connector for measurements.
- ✓ **IP 20 with DIN-rail mounting.**

www.procentec.com/profihub/b1/en

Other PROCENTEC products

ProfiHub B5

- ✓ 5 Isolated channels.
- ✓ Transparent for PROFIBUS DP.
- ✓ DP - RS 485 specifications.
- ✓ 31 devices per channel.
- ✓ 9,6 Kbps to 12 Mbps.
- ✓ 1200 m spur line length.
- ✓ No Address required.
- ✓ Integrated termination.
- ✓ LEDs that indicate the onboard termination.
- ✓ Screw terminals and DB9 connectors.
- ✓ **IP 20 classification.**

ProfiHub A5

- ✓ 5 Isolated channels.
- ✓ Transparent for PROFIBUS DP.
- ✓ DP - RS 485 specifications.
- ✓ 31 devices per channel.
- ✓ 9,6 Kbps to 12 Mbps.
- ✓ 1200 m spur line length.
- ✓ No Address required.
- ✓ Integrated termination.
- ✓ **IP 65 classification.**

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